

CLAIM AMENDMENTS

1 1. (currently amended) A diode-pumped laser apparatus
2 for generating a visible power beam, ~~of the type the laser~~
3 apparatus comprising:

4 a linear miniaturized laser cavity ~~[[(72) 5]]~~ having
5 crystals and a length that does not exceed the sum of ten times the
6 sum of the lengths of the crystals; comprising at least the
7 ~~following optical elements (30,33,36,10,20):—~~

8 ~~reflecting means~~ a plurality of reflectors ~~[[(30;33;36)]]~~
9 that are highly reflective at a fundamental wavelength of a laser
10 beam ~~[[(52)]]~~ generated by ~~said cavities~~ the laser cavity ~~[[(72)]]~~,
11 at least one of said ~~reflecting means~~ reflectors ~~[[(30)]]~~ being
12 traversed by a pumping beam, ~~(54), at least one of said reflecting~~
13 ~~means (36) being~~ and reflecting at said fundamental wavelength and
14 a second harmonic wavelength ~~[[(51)]]~~ with respect to said
15 fundamental wavelength, ~~and at least one of said reflecting means~~
16 ~~(33) being~~ highly transmissive at said second harmonic ~~[[(51)]]~~ of
17 said fundamental wavelength; ~~[[-]]~~

18 an active material ~~[[(10)]]~~ with linear polarized
19 emission and with a gain configuration with small thermal
20 aberration for ~~[[the]]~~ cavity mode, said active material ~~[[(10)]]~~
21 being able to generate said laser beam ~~[[(52)]]~~ at ~~[[a]]~~ the
22 fundamental wavelength; ~~[[-]]~~

23 a nonlinear crystal ~~[[(20),]]~~ inside said cavity ~~(72)—;~~

24 ~~characterized in that: said nonlinear crystal (20) is and~~ able to
25 generate a second harmonic ~~[[51]]~~ of said fundamental wavelength
26 by critical type I phase matching; ~~and and that said cavity (72) is~~
27 ~~associated to~~

28 thermostating means associated with the cavity
29 ~~(45,41,42,43,44)~~ for temperature locking said cavity, the
30 reflectors, the active material, and the nonlinear crystal (72) and
31 ~~its optical elements (30,33,36,10,20).~~

1 2. (currently amended) The ~~[[an]]~~ apparatus as claimed
2 in claim 1, ~~characterized in that wherein~~ said cavity ~~[[72]]~~ and
3 the optical means ~~(30,33,36,10,20)~~ which elements it comprises are
4 ~~selected provided to minimis~~ minimize optical losses.

1 3. (currently amended) ~~[[An]]~~ The apparatus as claimed
2 in claim 1, ~~characterized in that said wherein~~ optical losses at
3 said fundamental wavelength are less than 2%.

1 4. (currently amended) The ~~[[An]]~~ apparatus as claimed
2 in claim 1, ~~characterized in that said wherein~~ optical losses at
3 said fundamental wavelength due to thermal aberration are less than
4 1%.

1 5. (currently amended) The $[[An]]$ apparatus as claimed
2 in claim 1, ~~characterized in that~~ wherein the active material
3 $[(10)]$ is a crystal of $Nd:GdVO_4$.

1 6. (currently amended) The $[[An]]$ apparatus as claimed in
2 claim 1, ~~characterized in that~~ wherein the active material $[(10)]$
3 is a crystal of $Nd:YLF$.

1 7. (currently amended) The $[[An]]$ apparatus as claimed in
2 claim 1, ~~characterized in that~~ wherein the active material $[(10)]$
3 is a crystal of $Nd:YVO_4$.

1 8. (currently amended) The $[[An]]$ apparatus as claimed
2 in claim 5, ~~characterized in that~~ wherein the nonlinear crystal is
3 LBO.

1 9. (currently amended) The $[[An]]$ apparatus as claimed
2 in claim 5, ~~characterized in that~~ wherein the nonlinear crystal is
3 YCOB or GdCOB.

1 10. (currently amended) The $[[An]]$ apparatus as claimed
2 in claim 1, ~~characterized in that~~ wherein said visible beam ~~(51) is~~
3 ~~a beam~~ is at the limit of diffraction $[[,]]$ or $TEM_{0,0}$.

1 11. (currently amended) The [[An]] apparatus as claimed
2 in claim 1, ~~characterized in that~~ wherein the pumping beam [[(54)]]
3 is absorbed in two successive passes through the active material
4 [[(10)]].

1 12. (currently amended) The apparatus as claimed in
2 claim 1, ~~characterized in that~~ wherein said thermostating means
3 ~~{45;41;42;43;44}~~ for temperature locking said cavity, the
4 reflector, the active material, and the nonlinear crystal ~~(72) and~~
5 ~~its optical elements~~ comprise a mechanical structure
6 ~~{45;41;42;43;44}~~ associated [[to]] with said cavity [[(72)]].

1 13. (currently amended) The apparatus as claimed in
2 claim 12, ~~characterized in that~~ wherein said mechanical structure
3 comprise a structural base [[(45)]], and elements for supporting
4 the optics ~~{41;42;43;44}~~.

1 14. (currently amended) The apparatus as claimed in
2 claim 12, ~~characterized in that~~ wherein said structural base
3 [[(45)]] and elements supporting the optics ~~{41;42;43;44}~~ are made
4 of copper or other heat conducting material and ~~associated~~ are in
5 thermal contact with each other.

1 15. (currently amended) The [[An]] apparatus as claimed
2 in claim 12, ~~characterized in that~~ wherein the temperature of the
3 structural base [[(45)]] is regulated by means of an active system.

1 16. (currently amended) The [[An]] apparatus as claimed
2 in claim 12 wherein ~~characterized %: in that~~ said mechanical
3 structure ~~(45;41;42;43;44)~~ has the shape of a container, containing
4 said cavity [[(72)]] in sealed way.

1 17. (currently amended) The apparatus as claimed in
2 claim 1, ~~characterized in that~~ wherein said thermostating means
3 ~~(45;41;42;43;44)~~ comprise an additional autonomous heat-regulating
4 device to stabilize the temperature of the nonlinear crystal
5 [[(20)]] in autonomous and more precise way than the other elements
6 of the cavity.

1 18. (currently amended) The apparatus as claimed in
2 claim 1, ~~characterized in that~~ wherein the ~~reflecting means~~
3 reflectors ~~(30;33;36)~~ are at least in part ~~obtained by means of~~
4 formed by reflecting depositions on the laser crystal [[(10)]]
5 [[and/]] or on the nonlinear crystal [[(20)]].

1 19. (currently amended) A method for generating a
2 visible laser beam in a laser cavity [(72)] of the type whereby a
3 nonlinear crystal [(20)] is inserted into said laser cavity
4 [(72)] to obtain said visible laser beam [(51)] through a
5 second harmonic generation operation, ~~characterized in that it~~
6 ~~comprises the following operations~~ the method comprising the steps
7 of: [-]

8 selecting a nonlinear crystal [(20)] cut for critical
9 type I phase matching; [-]

10 aligning said nonlinear crystal [(20)] at a temperature
11 predetermined by [(the)] a thermostating means [(45)] associated
12 [(to)] with said cavity [(72)] obtaining the phase matching
13 condition; [-]

14 optimizing the conversion into second harmonic with
15 additional small temperature adjustments around the predetermined
16 value.

1 20. (currently amended) The method as claimed in claim
2 19, ~~characterized in that~~ wherein the temperature regulation
3 operation occurs in negative feedback, detecting [(the)] an actual-
4 value signal of a sensor positioned in proximity to the nonlinear
5 crystal.

1 21. (currently amended) The [[A]] method as claimed in
2 claim 19, ~~characterized in that it further comprises the operations~~
3 further comprising the steps of: [[-]]

4 reducing [[the]] walk-off of the fundamental laser beam
5 [[(52)]] operating on the dimension of the cavity mode inside the
6 nonlinear crystal [[(20)]], in order to contain [[the]] a walk-off
7 angle inside the divergence of the beam; [[-]]

8 selecting the length of the nonlinear crystal as a
9 function of the desired focusing.

1 22. (new) The apparatus according to claim 1 wherein
2 the active material is arranged to keep the aberration losses at
3 less than 2%.